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INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

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| Applicant's or agent's file reference P60570PC00 | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
| International application No. PCT/NL 03/00013 | International filing date (day/month/year) 09.01.2003 | Priority date (day/month/year) |
| International Patent Classification (IPC) or both national classification and IPC H01G9/00 | | |
| Applicant MOLECULAR BIOPHYSICS INC. et al. | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 6 sheets.
3. This report contains indications relating to the following items:
 - I Basis of the opinion
 - II Priority
 - III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV Lack of unity of invention
 - V Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI Certain documents cited
 - VII Certain defects in the international application
 - VIII Certain observations on the international application

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| Date of submission of the demand 03.08.2004 | Date of completion of this report 07.03.2005 |
| Name and mailing address of the International preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465 | Authorized Officer Ketterl, F Telephone No. +49 89 2399-2467 |



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/NL 03/00013

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1-21 as originally filed

Claims, Numbers

1-38 filed with telefax on 20.12.2004

Drawings, Sheets

1/4-4/4 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:
- the claims, Nos.:
- the drawings, sheets:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/NL 03/00013

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).
(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

see separate sheet

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | |
|-------------------------------|-------------|----------|
| Novelty (N) | Yes: Claims | 1,2,4-28 |
| | No: Claims | |
| Inventive step (IS) | Yes: Claims | 1,2,4-28 |
| | No: Claims | |
| Industrial applicability (IA) | Yes: Claims | 1,2,4-28 |
| | No: Claims | |

2. Citations and explanations

s separate sheet

CONCERNING SECTION I:

- 1). The following amendments go beyond the content of the application as filed, thus failing to meet the requirements of Article 34(2)(b) PCT.
 - 1.1 As regards amended claim 3, no basis can be found in the original application for the extension of the number of electrodes to **at least** three, and of the number of the junctions to **at least** two. Moreover, the embodiment shown in Fig.7, on which the amendment is intended to be based, is only disclosed in combination with one direct electrode in conductive contact with the channel interior.

Hence claim 3 as amended introduces technical information which is not directly and unambiguously derivable from the application as filed.
 - 1.2 The same applies to newly introduced claim 29. No basis can be found for generalizing the use of the device as a semiconductor device in general, or for the generalizing language of the feature "controlling the distribution of charge carriers in the channel interior to resemble a doping profile of the semiconductor device".
 - 1.3 Consequently, claims 30 to 38 which make reference to claim 29, likewise have to be considered as going beyond the content of the application as originally filed.
- 2). The report will therefore be established as if the above mentioned amendments had not been made, see Rule 70.2(c) PCT.

CONCERNING SECTION V:

The following comments assume that the lack of clarity of claim 1 outlined in paragraph 2.1 below is overcome by clarification. Moreover, the expression "at two control electrodes" is interpreted as "at least two control electrodes".

- 1). Reference is made to the following document:

D3: WO,A,0022427

This document is not mentioned in the International search report, but was cited by the applicant.

2). From D3, there is known (see Fig. 5 and page 12, line 22 to page 6, line 4) a bipolar electronic device which comprises at least one channel with a fluid fillable channel interior. An electrically insulating wall (insulators 32, 33) surrounds at least partially the channel interior which, in use, contains charge carriers (see page 8, lines 21 to 26). The device further comprises at least two control electrodes (conductors 34 and 35) which are electrically isolated from the channel interior and in capacitive contact with the channel interior.

In the device of D3, application of a voltage to conductors 34 or 35 cause a movement of the liquids in the vicinity of the upper or lower walls in the direction of arrows C and D, respectively.

2.1 Contrary to that, the electrodes of the claimed device control the charge carriers in an area of the channel interior between the electrodes such that at least one junction is obtained.

However, no substantial feature can be seen in claim 1 as presently worded by which such a different performance can be explained. Hence it must be concluded that present independent claim 1 does not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.

2.2 Claim 1, if amended so as to incorporate these missing essential features, would be new with respect to D3 and would therefore not only meet the requirements of Article 33(4) PCT, but also of Article 33(2) PCT.

2.3 An accordingly amended version of claim 1 would also meet the requirements of Article 33(3) PCT. There is no suggestion in D3 or in the other references cited in the International search report by which a skilled person would be prompted to modify the

known electronic device in a way that the different performance mentioned above is obtained.

- 3). Dependent claims 2 and 4 to 27 define embodiments of the bipolar device of claim 1 and would therefore also meet the requirements of Article 33(2) to (4) PCT.
- 3.1 The same holds for the integrated circuit of independent claim 28, which comprises at least one of such bipolar devices.

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Claims

1. A bipolar electronic device, comprising:
at least one channel with
5 a fluid fillable channel interior and
an electrically insulating wall surrounding at least partially the channel interior, which channel interior, in use, contains charge carriers,
which electronic device further comprises:
at two control electrodes, which electrodes are electrically isolated from the
10 channel interior and in capacitive contact with the channel interior, the control electrodes being able to control the charge carriers in an area of the channel interior between the control electrodes such that at least one junction is obtained.
- 15 2. A bipolar electronic device, as claimed in claim 1, wherein by appropriate changes of the charge or voltage on the control electrodes, the position of the at least one junction can be moved.
- 20 3. A bipolar electronic device as claimed in any one of the preceding claims, including at least three electrodes being able to control the charge carriers that in an area of the channel interior between the control electrodes at least two junctions are obtained.
- 25 4. A bipolar electronic device as claimed in any one of the preceding claims, further including at least one direct electrode in conductive contact with the channel interior.
- 30 5. A bipolar electronic device as claimed in any one of the preceding claims, wherein at least one of the junctions is an n-p junction.

Replacement sheet

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6. A bipolar electronic device as claimed in any one of the preceding claims, wherein the at least one channel in use contains a liquid in which charge carriers are present.

5 7. A bipolar electronic device as claimed in any one of the preceding claims, wherein the charge carriers include ions.

8. A bipolar electronic device as claimed in claim 6 or claims 6 and 7, wherein the liquid is an aqueous solution.

10 9. A bipolar electronic device as claimed in claim 7 and 8, wherein the ions include salt ions.

15 10. A bipolar electronic device as claimed in any one of the preceding claims, wherein the charge carriers include electrons.

11. A bipolar electronic device as claimed in any one of the preceding claims, wherein the at least one channel has:

a channel inlet, and

20 a channel outlet, at which channel inlet and outlet control electrodes are provided, which inlet and outlet control electrodes are each electrically connected to a control device arranged for controlling electrical properties of the channel inlet and outlet.

25 12. A bipolar electronic device as claimed in any one of the preceding claims, comprising at least two parallel channels.

13. A bipolar electronic device as claimed in claim 12, wherein two parallel channels are connected by at least one cross channel.

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14. A bipolar electronic device as claimed in any one of the preceding claims, wherein at least two of the control electrodes are positioned facing each other on opposite sides of the channel.

5 15. A bipolar electronic device as claimed in claim 14, wherein said at least two facing control electrodes are electrically connected to each other

16. A bipolar electronic device as claimed in any one of claims 1-15, wherein at least two of the control electrodes are electrically insulated from each other.

10 17. A bipolar electronic device as claimed in any one of claims 1-16, further comprising a control device, communicatively connected to the control electrodes, which control device is arranged for controlling electrical properties of the electrodes.

15 18. A bipolar electronic device as claimed in claim 17, wherein the control device includes a software programmable apparatus.

19. A bipolar electronic device as claimed in claim 13, wherein said cross channel is situated between two adjacent electrodes of at least one of said channels as seen in the longitudinal direction of said channels.

20 25 21. A bipolar electronic device as claimed in any one of the preceding claims, wherein at least one of said electrodes is a gate electrode.

22. A bipolar electronic device as claimed in any one of the preceding claims, wherein at least one channel has a rectangular shaped cross-section.

30 23. A bipolar electronic device as claimed in any one of the preceding claims, wherein at least one channel is a substantially straight channel.

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23. A bipolar electronic device as claimed in any one of the claims 1-22, wherein at least one channel has a curved shape.
- 5 24. A bipolar electronic device as claimed in claim 23, wherein said channel has an annular shape.
- 10 25. A bipolar electronic device as claimed in any one of the preceding claims, further comprising: a catalyst or reactant material on the electrically insulating wall in said channel interior, which material in use lies within an electrical field of at least one of the electrodes.
- 15 26. A bipolar electronic device as claimed in any one of the preceding claims, wherein at least a part of the electrically insulating wall contains a permeable material through which permeable material a reaction or catalysis product can diffuse out of said channel.
- 20 27. A bipolar electronic device as claimed in any one of the preceding claims, wherein a polyelectrolyte material is present in the channel.
28. An integrated circuit comprising at least one bipolar device as claimed in any one of the preceding claims.
- 25 29. Use as a semiconductor device of a device comprising at least one channel with a fluid fillable channel interior which contains charge carriers; an electrically insulating wall surrounding at least partially the channel interior; and at one control electrode electrically isolated from the channel interior and in capacitive contact with the channel interior, the use including controlling the distribution of charge carriers in the channel interior to resemble a doping profile of the semiconductor device.

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30. Use as claimed in claim 29, including use of the device as a unipolar device, such as a MOSFET or a Schottky diode.
- 5 31. Use as claimed in claim 29 or 30, including use of the device as a bipolar device, such as a P-N junction diode.
32. Use as claimed in any one of claims 29-31, including controlling the charge carriers in the channel interior to create junctions, such as P-N, P-P++, or N-N++ junctions for example.
- 10 33. Use as claimed in any one of claims 29-32, including moving the doping profile, for example by moving the position of junctions in the doping profile.
- 15 34. Use as claimed in any one of claims 29-33, including use of the device as a transistor.
35. Use as claimed in any one of claims 29-34, including use of the electronic device as a bipolar device with current injection, such as a bipolar junction transistor.
- 20 36. Use as claimed in any one of claims 29-35, including use of the device as a series arrangement of semiconductor devices.
- 25 37. Use as claimed in any one of claims 29-36, including changing the doping profile in time.
38. A computer program product, comprising program code for performing steps of a method as claimed in any one of claims 29-37 when run on a

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programmable device, the programmable device being arranged to control at least one of the control electrodes.